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A CROSS-COUNTRY STUDY OF THE AGRICULTURAL PRICE LEVEL

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by

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I. Introduction*

The Food and Agricultural Organization has recently collected a large body of data containing agricultural prices for many countries. The FAO has used this data base to calculate a Geary-Khamis system of world agricultural prices and agricultural purchasing-power parities for each country in the sample (FAO, 1986). The appearance of these data affords an opportunity to formulate and then test some theories of the agricultural price level. There is a theoretical and empirical literature on the "national price level", which is defined as the ratio of a purchasing-power parity (over the whole of GDP) to an exchange rate (Kravis and Lipsey, 1984; Clague, 1985; Officer, 1990; Falvey and Gemmell, 1991). The theoretical ideas in this literature have not been applied to the agricultural price level, and this application is one of the objectives of the present paper.

Agricultural price levels are of interest for what they reveal about comparative advantage and about government policy with respect to agriculture. Conventional wisdom is that the agricultural sector tends to be the victim of government discrimination in less-developed countries and the beneficiary of government protection in more-developed countries; a previous study (Rao et al., 1990) has suggested that this piece of conventional wisdom is not supported by the FAO data. By developing a theoretical model of the agricultural price level and by dealing with the question of problematic data in some of the countries, this study will attempt to throw light on this issue as well as on

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the fundamental determinants of this price level.

There is a choice to be made in defining the agricultural price level. Because the FAO agricultural purchasing-power parities are expressed in units of local currency per unit of the numeraire currency (the U.S. dollar), in order to compare these PPP's across countries in a meaningful way, they must be related either to an exchange rate or some other PPP (such as the PPP for the whole of GDP). The exchange rate data are more plentiful: there are official exchange rates for all countries, and black market rates for most of them. Benchmark PPP's are available for a more limited set of countries and time periods. Tests will be run with all three choices. The Rao et al. study made use of the PPP's, and one purpose of the present study is to see how their conclusions are affected by the use of exchange rates instead.

The organization of the paper is as follows. Section II presents the model of the agricultural price level and describes the tests suggested by the model. Empirical procedures are described in Section III and the results of the tests are contained in Section IV. Concluding observations are in Section V.

II. A Model of the Agricultural Price Level

The agricultural price level is defined in a manner analogous to the national price level: it is the agricultural PPP (expressed in, say, pesos per dollar) divided by an exchange rate (in pesos per dollar). We begin by describing a model that has been used in the explanation of the national price level (Clague, 1988). The model pictures a small economy trading with a single entity called the "Rest of the World". The economy contains three sectors, exportables, importables, and services or nontradeables. Each of the tradeable sectors has its own specific factor; labor is mobile across all three sectors and is the only factor in the service sector. In the basic theory of national price levels, it is assumed that there are no trade barriers and no transport costs. Hence the prices of tradeable goods are the same in the particular country and in the Rest of the World and it is only differences in the prices of services that give rise to international differences in national price levels. If agricultural goods are considered as tradeables, then clearly such a model cannot explain why agricultural price levels (agricultural PPP's deflated by exchange rates) differ across countries.

For the purposes of the present paper, the model is modified in several ways. First, transport costs are introduced to permit some international differences in the prices of tradeable goods. Second, in place of the two tradeable sectors (exportables and importables), the model will distinguish three broad tradeable sectors: agriculture, mining, and industry. Each sector is assumed to have its own specific factor: land in agriculture, mineral deposits in mining, and industrial capital in industry. Third, the model needs to account for the observed fact that countries normally export some agricultural products and import others. This adaptation in the model is made by disaggregating the agricultural sector into many products, and for simplicity it will be assumed that for each such product there is a distinct specific factor. (These may be thought of as distinct land-water-climate conditions.)

To illustrate the operation of the model, let us consider a graphical depiction of the labor market in the particular country. The length of the box on the left in Fig. 1 represents the entire labor force in the economy. The vertical axis is scaled in units of domestic currency and is used to measure the wage rate. The curve D_A is the demand curve for labor in agriculture, while the curve D_{MI} is the combined labor demand curve in mining and industry. These demand curves for labor in tradeable goods depend on the endowments of the relevant specific factors and on the world prices of the various goods and the transport costs of the goods.

In the right-hand quadrant of Fig. 1 the curve S_{NT} represents the supply of labor to the nontradeable sector; it is derived simply as the horizontal distance at each wage rate between the D_{MI} and the D_A curves. The downward-sloping D_{NT} curve in Fig. 1 is the demand for nontradeables labor; the curve slopes downward because consumers buy more nontradeables as their price (the wage rate) falls.

Let the exchange rate be the numeraire and the wage rate be the variable that equilibrates the balance of payments. Taking the prices in the Rest of the World as given (the country in question is assumed to be "small"), let us show that the wage rate in the particular country will be higher, the greater the country's endowments of specific factors. The greater these endowments, the higher will be the demand curves for labor in the tradeable sectors and hence the lower will be the supply of labor to the nontradeables sector. The richer endowment of specific factors implies a higher level of real income, which also shifts up the demand curve for nontradeables, and consequently the wage rate (which is the price of nontradeables) unambiguously rises. This conclusion is familiar from the standard national price level model (Clague, 1988): Resource-abundant countries will tend to have high national price levels. The present paper will focus on countries' <u>relative</u> endowments of land, mineral deposits, and industrial capital.

To bring out the implications of differences in relative resource endowments, assume for the moment that all goods have the same transport costs between the particular country and the Rest of the World. A country that is well endowed with industrial capital and mineral deposits and poorly endowed with land will for obvious reasons import most of its agricultural consumption. Because imported goods will be more expensive and exported goods will be less expensive in the particular country than in the Rest of the World, this country will have a high agricultural price level. Conversely, a country well endowed with land and poorly endowed with mineral deposits and industrial capital will export most agricultural products and have a low agricultural price level.

The proposition just stated will now be formalized and generalized to allow for different transport costs for different goods. An expression is developed for the agricultural price level of the small country that is trading with the Rest of the World. There are many agricultural products, which are indexed by i = 1,...I. The units of quantity are defined such that the "world price" of each agricultural good is equal to unity. The exchange rate is also set equal to unity for convenience.

Let us divide the country's agricultural products into three categories: export goods, goods not actually traded internationally, and imported goods. Define the transport cost between the particular country and the Rest of the World on good i as t_i. Clearly the domestic prices of export goods in the particular country will be below unity, and those of imported goods will be above unity. The prices of goods not actually traded will lie within the bounds given by transport costs in either direction (which are assumed to be equal). More precisely, the price of an export good will be $1 - t_i$, that for an imported good will be $1 + t_i$, and that for a good not actually traded must lie between $1 - t_i$ and $1 + t_i$. Let X_i be the domestic production of good i, and p_i the domestic price. Since the world prices are all unity, the agricultural price level in the country is

$$APL = \Sigma p_i X_i / \Sigma$$

Let us denote the export goods by $i = 1,\ldots I_1$, the goods not actually traded by $i = I_1+1,\ldots I_2$, and the imported goods by $i = I_2+1,\ldots I$. Thus we have

$$APL = \{\sum_{i=1}^{I_1} (1-t_i) X_i + \sum_{i=I_1+1}^{I_2} p_i X_i + \sum_{i=I_2+1}^{I} (1+t_i) X_i\} \ / \ \Sigma X_i \tag{1}$$

Equation (1) gives a precise expression for the agricultural price level in terms of the domestic production shares and the international transport costs of the various commodities. Before commenting on the role of these variables, let us show how the conclusion established above, that an increase in a country's endowment of mineral resources and industrial capital will raise its APL, can be seen to hold in equation (1). The conclusion follows from the fact that an increased endowment of these resources raises the wage rate. A higher wage rate pulls goods into the import category from the not-traded category and pushes goods out of the export category into the not-traded category. In other words, it reduces the value of I_1 and I_2. Equation (1) shows that these changes in I_1 and I_2 raise APL. The higher wage also raises the cost of production and the price of not-traded goods (those indexed from $I_1 + 1$ to I_2), reinforcing the changes in I_1 and I_2.

However, the APL does not depend only on resource endowments, nor on the trade patterns determined by resource endowments. It is possible for a country to have a low APL despite having a large import surplus of agricultural goods. Recall that in (1) the prices are weighted by the <u>domestic production</u> quantities. Suppose a land-poor country with an agricultural import surplus did not produce any of the agricultural goods that it imported. Suppose further that domestic agricultural production was concentrated in some goods that were exported subject to heavy transport costs. For such a country the APL would be low, despite its poor land endowment and its agricultural import surplus. This curious result shows that even at the theoretical level, there is not a perfect negative matching across countries or over time of the agricultural price level and the agricultural trade balance. However, in the empirical analysis it seems reasonable to assume that the peculiar conditions required for this curious result are not commonly present and that, data problems aside, it is to be expected that the agricultural price level and the agricultural trade balance will be strongly (but not perfectly) negatively correlated in a sample of countries.

The agricultural price level will also be affected by government policies that protect or discriminate against agriculture. The theory of national price levels suggests that import tariffs and other barriers to imports and export subsidies raise the national price level, while export tariffs reduce it (Clague, 1988). (For a qualification in the case of labor market distortions see Feldman, 1990.) The same logic applies to the agricultural price level. The role of man-made barriers and subsidies can be illustrated in equation (1). Suppose that transport costs are zero. Let the t_i refer to export taxes and import taxes on the various products. Export subsidies are interpreted as negative export taxes. Quantitative restrictions on imports must be converted to equivalent import tariffs. Let us note first that import tariffs (or equivalent import quotas) and export subsidies raise the equilibrium wage rate. This conclusion follows because these measures shift up the D_A curve in Fig. 1, while they do not alter the D_{MI} and D_{NT} curves. The rise in the wage rate shifts up the costs and hence the prices of agricultural goods in the not traded category. At the same time, the imposition of import barriers and export subsidies raises the prices of the affected goods in the exported and import-competing categories. In the final equilibrium, it is clear that the APL will be higher, the greater the positive t_i on the imported goods and the greater in absolute value the negative t_i on the exported goods. Conversely, the APL will be lower, the greater the positive t_i on the exported goods.

Regression equations suggested by the theoretical model. In a laissez-faire world, the testing of the model would be fairly straightforward. In the real world, the task is complicated by the presence of government interventions in agricultural and other markets and the fact that appropriate measures of these interventions are not available for large numbers of countries.

The model suggests that APL is negatively related to the agricultural trade balance, but both this balance and the APL itself are affected by government interventions and thus both variables are endogenous to the model. These problems can be ameliorated (but not eliminated) by regressing APL on the determinants of the agricultural trade balance, as will now be explained.

The agricultural trade balance is measured by the net normalized exports of agricultural products, or NNX, which equals (X-M)/(X+M), where X and M refer to exports and imports of agricultural products. This trade balance is strongly affected by the country's endowment of land resources relative to other factors of production. Measures of factor endowments are population density per unit of agricultural land (DENS), the share of mining in GDP (MINS, for mineral share), and real income (RELY), which reflects accumulations of physical and human capital and technological level. These are determinants of NNX_1, or what the agricultural trade balance would be in the absence of government interventions, as shown in (2),

$$NNX_1 = a + b\,RELY + c\,DENS + d\,MINS + \epsilon_1 \qquad (2)$$

where ϵ_1 is an error term. The actual trade balance is affected

by government interventions that change the prices faced by consumers and producers of agricultural products. These price changes will be denoted PCD and PPD for consumer prices and producer prices respectively. The actual trade balance is then

$$NNX = NNX_1 + e\,PDC + f\,PPD + \epsilon_2 \qquad (3)$$

The agricultural price level APL, which is an index of producer prices, is determined by the intervention-free trade balance (NNX_1) and the government-induced change in producer prices (PPD).

$$APL = g + h\,NNX_1 + i\,PPD + \epsilon_3 \qquad (4)$$

where the coefficient i is presumably close to unity. Since the price change variables are not available, (4) would have to be approximated as follows.

$$APL = g' + h'NNX + \epsilon_4 \quad (5)$$

The coefficient h' in (5) is a mixture of the coefficient h in (4) and the influence of the PPD variable in (3) and (4). This problem can be avoided by regressing APL on the determinants of NNX_1, as in (6).

$$APL = k\,RELY + l\,DENS + m\,MINS + \epsilon_5 \quad (6)$$

In this equation it seems reasonable to treat population density (DENS) and the mineral share (MINS) as exogenous[1]. Real income also seems likely to be exogenous to APL, but to test that assumption the Hausman test was run (using primary and secondary education to instrument real income), and the null hypothesis of exogeneity could not be rejected.

There is a missing variable in (6), however, that should be kept in mind. The PPD variable is a measure of government favoritism toward agriculture. The theory of collective action (Olson, 1984) and empirical investigation (Anderson and Hayami, 1986) support the proposition that PPD is higher in countries with a negative agricultural trade balance. It is easier for producers to extract resources from the rest of the economy by pushing for barriers to imports than by attempting to obtain explicit subsidies from the government budget. Therefore, if the independent variables in (6) are such as to produce a negative agricultural

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[1] Population density is determined by historical patterns of land settlement and past population growth. The mineral share in GDP is determined largely by endowments of mineral resources and government policies that have influenced their exploitation.

trade balance, there is likely to be an above-average value of PPD, which will increase APL. There is also the possibility that favoritism toward agriculture is positively related to real income; this proposition is supported by conventional wisdom and empirical evidence (Anderson and Hayami, 1986). If so, then the coefficient of RELY in (6) is upward biased on this account.

In running the statistical tests one has a choice of whether to use the official or the black market exchange rate. One should use the exchange rate which best reflects the prices at which tradeable goods are sold within the country. For countries with severely distorted official rates, it seems likely that the black market rate is a more accurate reflection of these prices. Our results tend to confirm this suggestion, as will be explained below.

The difficulty with using the aggregate PPP as the denominator in the definition of the agricultural price level is that this PPP includes the prices of nontradeables. Consequently the theory of the agricultural price level defined in this manner would need to take account of international variation in the price of nontradeables. Regressions were run in the same form for this variable as for the APL defined using the exchange rate, but the real income variable now reflects the well-known positive association between real income and the relative price of nontradeables. This point is discussed more fully in the description of the results in Section IV.

III. Description of the Data and Empirical Procedures

A. Agricultural Price Levels

The FAO (1986) provides agricultural price levels for over 90 countries in 1970, 1975, and 1980. The centrally planned economies were excluded from the study on the grounds that the theory developed above is not applicable to them; this leaves a sample of 82 countries. The source provides a wealth of data on individual commodity categories, but only the aggregate data are used in this study.

The source provides Geary-Khamis (Geary, 1958; Khamis, 1970, 1972) indexes of agricultural PPP's. The GK system starts from the category-level prices (e.g. pesos per ton) of each country and it calculates simultaneously the world category prices and each country's overall agricultural PPP (relative to the numeraire currency, the U.S. dollar). This PPP may be interpreted as the cost in domestic currency of a bundle of goods that cost one dollar at international prices. The weights in this bundle are the quantities of domestic production of the various goods in the particular country (FAO, 1986, p. 21).

The official exchange rates are provided in the FAO publication. The black market rates are taken from World Bank (1991). The original source is the World Currency Yearbook. The aggregate PPP data, available for 60 benchmark countries in 1980, are from UN (1986). There are 51 countries with data from both the

FAO and this UN source[2].

B. Independent Variables

The real income variable (RELY) is income per capita relative to the United States converted at PPP rather than at the exchange rate. It is taken from Summers and Heston (1988).

The agricultural trade balance (NNX) is taken from the FAO Trade Yearbook. Data were missing for Angola, Burundi, Mozambique, and Afghanistan. For these countries, data on the composition of exports and imports from the World Bank's World Tables 1980 were combined with the IMF's International Financial Statistics data on merchandise exports and imports to give estimates of agricultural exports and imports. There were no data on Nepal from either the FAO or the World Bank. Its pattern of agricultural trade was assumed to resemble that of South Asia as a whole. Trade data for Iran and Iraq were missing for 1980; the trade balance for 1975 was used in its place.

The mineral share in GDP (MINS) is taken from World Tables 1980, and refers to the years 1970-77. Some countries do not separate mining from the rest of industry; in these cases the mineral share was set equal to 0.5%. The mineral share is in fact rather small for most countries. The median share is only 2.5%, while the mean is 4.8%. Only eleven countries have mineral shares in excess of 10%.

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[2] The Penn World Tables (Summers and Heston, 1991) provide short-cut estimates of PPP's for nonbenchmark countries, but these are regarded as much less reliable than the benchmark estimates.

Population density was measured in several different ways. Total population was divided by (1) total land area of the country, (2) arable plus permanent crop land plus pasture land, or (3) arable plus permanent crop land. The results were quite similar for definitions (2) and (3); the results were somewhat poorer for the first definition, as might be expected, since this definition makes no allowance for land quality. The variable used in the results shown here was population divided by the sum of arable plus permanent crop land and one-half of pasture land.[3] The data were taken from the FAO Production Yearbook.

The density variable represents the three northern European countries, Norway, Sweden, and Finland as having low population densities. The variable as measured takes no account of the temperature; when temperature is considered, these three countries would not seem to have a low density of population per unit of productive agricultural land. For this reason a dummy for these countries (denoted SCAN, for Scandinavian) was inserted into the regressions wherever the density variable appeared.

IV. Results of the Tests

A. Tests Using the Exchange-Rate-Based Agricultural Price Level

The tests were run with the official exchange rates and the black market rates, and they were run on three different samples:

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[3] To facilitate comparison of different density measures (see unpublished data appendix), the variable is measured in standardized form, that is, in units of standard deviation from the mean.

the entire sample, the sample of more-developed countries, and a sample of countries with apparently problem-free data; this last will be called the quality sample for short. Using official exchange rates, there are 82 countries in the entire sample, 22 more-developed countries, and 65 countries in the quality sample. The use of black market rates cuts the sample sizes to 75, 22 and 63.

The quality sample was formed by dropping countries for which there was missing trade data (as mentioned in Section III) and countries which exhibited large intertemporal variation in the agricultural price level defined with official rates[4]. Such variation is an indication that either the country's agricultural price data are poor[5] or the country's exchange rate is badly misaligned with prices.

Tests for the full sample are in Table 1, those for the more-developed countries in Table 2, and those for the quality sample in Table 3. The format of the three tables is the same. The agricultural trade balance regressions are in Panel A, the

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[4] The price level for each country was expressed relative to the world average price level by dividing by the 82-country average for each year (these averages were 101, 113, and 137 for 1970, 1975, and 1980; the rise in the world average reflects the well-known decline in the U.S. dollar over this period (e.g. Wood, 1991). The coefficient of variation for each country was then calculated for the three years. Countries with a coefficient of variation exceeding 0.20 were excluded from the quality sample. All the data used in this paper are in an unpublished appendix available from the author.

[5] The FAO acknowledges (FAO, 1986, p. 10) that the somewhat different procedures used in the different countries may compromise the international comparability of the price levels.

agricultural price regressions using official exchange rates are in Panel B, those using the black market rates are in Panel C, and the R^2 between the trade balance and the price level are in Panel D.

The full sample results in Table 1 show that the agricultural trade balance (Panel A) is explained fairly well by the factor endowment proxies. The value of R^2 exceeds 0.43 in all three years and the independent variables, real income, the mineral share, and population density all have the expected negative signs. The price level regressions with official exchange rates indicate problems with either the price data or the official exchange rates; the R^2 falls sharply from 1975 to 1980. The dummy for African countries shows an interesting pattern. The dummy is negative in 1970, near zero in 1975, and a striking 0.37 in 1980, indicating that agricultural prices in the typical African country were 37% higher than in a similarly endowed country in another region. When the black market rates are used, the drop in R^2 is much less pronounced and the African dummy remains insignificant throughout.

Population density is a strong variable in all the regressions. The mineral share is sometimes significant and sometimes not. One might expect the mineral share to be more significant in 1975 and 1980 (after the oil shocks) than in 1970, and this pattern appears with the official rates but not the black market rates. Real income is a much stronger variable with black market rates than with official rates; this result is expected because the black market premiums tend to be higher for low-income countries. (Note that the use of the black market rate does not change the real income variable, only the agricultural price level.)

In the sample of the more-developed countries (Table 2) the fits for the price-level tests are considerably better. Neither the mineral share nor real income were successful variables in this sample, but the agricultural price level was quite well explained (R^2 of 0.60 or higher) by population density and the Scandinavian dummy. The trade balance results are not as strong for this sample as for the full sample; the theoretical model is probably more appropriate for a sample that includes both the LDC's and the more-developed countries.

In the quality sample (Table 3) the trade balance results are very similar to those for the full sample. The price level fits for the official exchange rates are markedly better than in the full sample. The real income variable also comes in strongly positive in this sample. Moreover, the dummy for African countries is not significant in any year. The results with black market rates are also a little stronger for the quality sample than for the full sample, but the differences are not as pronounced as for the official rates. In conclusion, with the black market rates or the quality sample, the theory of agricultural price levels finds considerable support, and real income is positively related to the agricultural price level.

B. Tests Using PPP-Based Agricultural Price Level

An alternative definition of the agricultural price level is the ratio of the agricultural PPP (pesos per dollar) to an aggregate PPP for the whole of GDP (pesos per dollar). This concept will be denoted APLPPP, in contrast to APL, the concept with an exchange rate in the denominator.

Real income is positively correlated (0.34) with APL in the sample of 50 countries with both FAO and UN data, while real income is negatively correlated with APLPPP (-0.37). The reason for the difference between these two correlations is that the aggregate PPP includes the prices of nontradeables, which are quite strongly positively correlated with real income.

The Rao et al. (1990) study reported that APLPPP is higher for poorer than for richer countries, and argued that this finding challenged the conventional wisdom that agriculture is the victim of policy discrimination in poor countries. But the fact that APLPPP is negatively correlated with real income may not indicate anything about policy with respect to agriculture, but may merely reflect the well known pattern of nontradeable prices in relation to income.

Table 4 shows the price level regressions, using APL (with official exchange rates), APL (with black market rates), and APLPPP. The APL regressions are very similar to the results for the quality sample (see Table 3); thus the change in sample size has very little effect on the results. Real income has a significantly positive coefficient and the African dummy is insignificant. In the APLPPP regression, real income is strongly negative, but the mineral share and density remain positive and significant (although somewhat weakly in the case of the mineral share). Interestingly, the African dummy is now strongly negative, with a coefficient of -0.85. Holding the other variables constant, African countries have APLPPP 85 points below those of other regions. This coefficient is consistent with a policy of repression of agricultural prices in Africa, in accordance with the conventional wisdom.

V. Summary and Conclusions

The results of this paper may be summarized as follows. The theoretical model predicts that with uniform transport costs on all agricultural goods, the agricultural price level will be negatively correlated with the agricultural trade balance in a sample of countries. With different transport costs on different goods, there is a theoretical possibility that this negative association may not hold, but this curious result seems unlikely to arise in practice.

The model suggests that the agricultural price level will be positively related to the mineral share in GDP and to population density. The density variable was strong in all the samples and the mineral share was fairly successful in samples that included less-developed countries.

The fits of the regressions were better for the agricultural price levels defined with black market exchange rates than for those defined with official exchange rates. The fits improved substantially for the official-exchange-rate measure when the countries with problematic data were removed. In the quality sample and with the black market exchange rates real income comes in with a positive and significant coefficient. This positive coefficient is consistent with an interpretation in which richer countries tend to have comparative advantage in nonagricultural goods and with an interpretation in which the lobbying power of agricultural interests tends to increase as the country's income increases. The findings on the whole were consistent with the conventional wisdom that the agricultural sector tends to be the victim of discrimination in LDC's and the beneficiary of favoritism in more-developed countries.

Figure 1

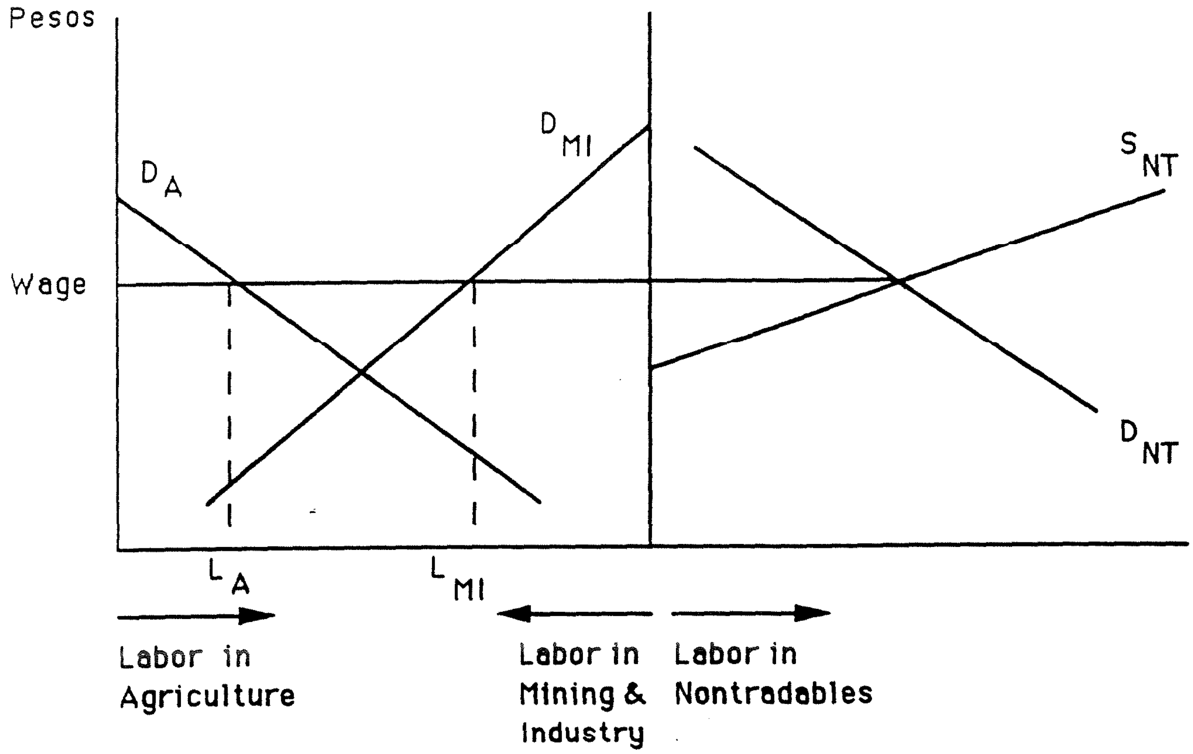
Pesos
Wage
D_A
D_{MI}
S_{NT}
D_{NT}
L_A
L_{MI}
Labor in Agriculture
Labor in Mining & Industry
Labor in Nontradables

Table 1. Tests with Full Sample (22 Observations)

	Intercept	Real Income	Mineral Share	Density	Scandi-navia	Africa	R^2
A. Dependent Variable: Agricultural Trade Balance							
1970	.5277	-.6586	-1.8490	-.1954	-.6197		.4322
	(8.27)	(-4.02)	(-3.91)	(-4.80)	(-2.74)		
1975	.4357	-.4284	-2.8460	-.2192	-.6270		.4616
	(6.69)	(-2.73)	(-5.83)	(-5.16)	(2.63)		
1980	.4512	-.4352	-3.1374	-.2135	-.5972		.4808
	(6.91)	(2.79)	(6.42)	(-5.01)	(-2.50)		
B. Dependent Variable: Agricultural Price Level (Official Exchange Rate)							
1970	.9356	.0017	.0060	.1440	.5221	-.0950	.3699
	16.39)	(1.32)	(1.80)	(4.87)	(3.29)	(-1.28)	
1975	.8110	.0034	.0093	.1716	.4820	.0952	.3601
	(12.94)	(2.62)	(2.53)	(5.24)	(2.71)	(1.15)	
1980	.7276	.0027	.0176	.1656	.4733	.3727	.1333
	(6.31)	(1.16)	(2.64)	(2.79)	(1.46)	(2.46)	
*C. Dependent Variable: Agricultural Price Level (Black Market Rate)**							
1970	.6978	.0050	.0045	.1217	.5105	-.0696	.4610
	(11.87)	(3.90)	(1.33)	(4.03)	(3.24)	(-0.88)	
1975	.6425	.0054	.0070	.1671	.4807	-.0546	.5086
	(10.37)	(4.24)	(2.00)	(5.24)	(2.85)	(-0.65)	
1980	.6271	.0049	.0032	.1471	.4021	.0482	.3849
	(9.25)	(3.61)	(0.85)	(4.27)	(2.21)	(.053)	

D. R^2 of Agricultural Price Level on Agricultural Trade Balance

	Official Exchange Rate	Black Market Rate
1970	.2798	.3535
1975	.2492	.3664
1980	.0593	.2212

Notes: *) 74 observations.
a) R^2 has been adjusted for degrees of freedom
b) t-values in parentheses

Table 2. Tests with More-Developed Countries (22 Observations)

	Intercept	Density	Scandinavia	R^2
A. Dependent Variable: Agricultural Trade Balance				
1970	.01857	-.1987	-.6197	.3671
	(0.21)	(3.24)	(-2.74)	
1975	.0154	-.2056	-.5844	.3553
	(.17)	(-3.24)	(-2.41)	
1980	.0571	-.2046	-.5990	.4003
	(.67)	(-3.49)	(-2.67)	
B. Dependent Variable: Agricultural Price Level (Official Exchange Rate)				
1970	1.0760	.1851	.5244	.6919
	(24.94)	(6.18)	(4.57)	
1975	1.1039	.2007	.4897	.6061
	(20.54)	(5.38)	(3.43)	
1980	.9753	.1998	.4879	.5948
	(17.83)	(5.26)	(3.35)	
*C. Dependent Variable: Agricultural Price Level (Black Market Rate)**				
1970	1.0520	.1742	.5392	.6737
	(24.10)	(5.76)	(4.64)	
1975	1.0447	.2070	.5392	.6011
	(18.36)	(5.24)	(3.62)	
1980	.9679	.2102	.4968	.6004
	(17.72)	(5.30)	(3.42)	

D. R^2 of Agricultural Price Level on Agricultural Trade Balance

	Official Exchange Rate	Black Market Rate
1970	.5264	.5683
1975	.5300	.3848
1980	.6267	.6185

Notes: *) 21 observations

a) R^2 has been adjusted for degrees of freedom

b) t-values in parentheses

Table 3. Tests with Quality Sample (65 Observations)

	Itercept	Real Income	Mineral Share	Density	Scandi-navia	Africa	R^2
A. Dependent Variable: Agricultural Trade Balance							
1970	.5321	-.6619	-2.1476	-.1915	-.6163		.3790
	(6.04)	(-3.36)	(-2.70)	(-4.03)	(-2.46)		
1975	.4273	-.4106	-3.1173	-.2069	-.6247		.3887
	(4.95)	(-2.27)	(-4.00)	(-4.41)	(-2.43)		
1980	.4202	-.3758	-3.6868	-.2067	-.6061		.4006
	(4.81)	(-2.07)	(-4.72)	(-4.37)	(-2.41)		
B. Dependent Variable: Agricultural Price Level (Official Exchange Rate)							
1970	.8471	.2835	1.3437	.1634	.5269	-.0643	.4928
	(13.90)	(2.27)	(2.87)	(5.73)	(3.58)	(-0.79)	
1975	.7629	.4195	1.3632	.1533	.4533	.0495	.4603
	(11.79)	(3.38)	(2.78)	(5.08)	(2.88)	(0.57)	
1980	.7295	.2989	2.3070	.1517	.4376	.0562	.4465
	(10.96)	(2.36)	(4.66)	(4.98)	(2.74)	(0.63)	
*C. Dependent Variable: Agricultural Price Level (Black Market Rate)**							
1970	.6965	.4971	.5873	.1308	.5169	-.0850	.4591
	(10.10)	(3.52)	(1.11)	(4.05)	(3.11)	(-0.88)	
1975	.6384	.5276	1.0749	.1749	.4901	-.0374	.5183
	(9.01)	(3.88)	(1.99)	(5.30)	(2.85)	(-0.38)	
1980	.6138	.5078	.9549	.1499	.3969	-.0020	.4563
	(8.58)	(3.74)	(1.79)	(4.58)	(2.32)	(-0.02)	

D. R^2 of Agricultural Price Level and Agricultural Trade Balance

	Official Exchange Rate	Black Market Rate*
1970	.3904	.3782
1975	.3789	.3745
1980	.4285	.2971

Notes: *) 63 observations
a) R^2 has been adjusted for degrees of freedom
b) t-values in parentheses

Table 4. Tests With ICP Sample (50 Observations in 1980)

	Intercept	Real Income	Mineral Share	Density	Scandi-navia	Africa	R^2
A. Dependent Variable: Agricultural Price Level (Official Exchange Rate)							
	.7299	.2649	2.140	.1792	.6006	.0294	.5538
	(11.2)	(2.12)	(4.24)	(6.10)	(2.65)	(0.34)	
B. Dependent Variable: Agricultural Price Level (Black Market Rate)							
	.9374	.4916	1.660	.2195	.8052	−.1330	.5323
	(9.49)	(2.64)	(2.23)	(5.06)	(2.41)	(−1.03)	
C. Dependent Variable: PPP-Based Agricultural Price Level							
	2.4550	−1.7506	1.8557	.3352	.6479	−.8480	.5776
	(17.33)	(−6.46)	(1.69)	(5.25)	(1.32)	(−4.51)	

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